GB04/01764

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

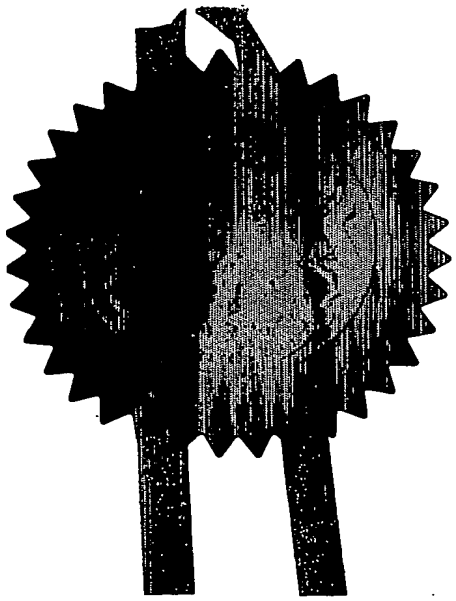
REC'D 05 JUL 2004
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.



Signed

Dated 25 June 2004

nts Form 1/77

s Act 16)

PATENTS • DESIGNS • COPYRIGHT • TRADE MARKS
The Patent Office

1/77

THE PATENT OFFICE
G
24 APR 2003
LONDON

quest for grant of a patent

be notes on the back of this form. You can also get an natory leaflet from the Patent Office to help you fill in orm)

The Patent Office

Cardiff Road
Newport
South Wales
NP10 8QQ

Your reference: MCM/PWJ/25285GB

Patent application number
(The Patent Office will fill in this part): 0309310.1

25APR03 E802434-1 D02000
P01/7700 0.00-0309310.1

Full name, address and postcode of the or of each applicant *(underline all surnames)*:

MEMCO Limited
Memco House
Waldeck Road
Maidenhead
Berks SL6 8BZ

Patents ADP number *(if you know it)*:

If the applicant is a corporate body, give the country/state of its incorporation: UNITED KINGDOM

5918974002

Title of the invention: Multifunction Edge Device For Powered Doors

Name of your agent *(if you have one)*:

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*:

MATHYS & SQUIRE
100 Gray's Inn Road
London WC1X 8AL
United Kingdom

Patents ADP number *(if you know it)*: 1081001

If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or of each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer 'Yes' if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
See note (d))

YES

Patents Form 1/77

Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	11
Claim(s)	6
Abstract	1
Drawing(s)	6 + 6 dk

0. If you are also filing any of the following, state how many against each item.

Priority documents	-
Translations of priority documents	-
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	-
Request for preliminary examination and search *(Patents Form 9/77)*	-
Request for substantive examination *(Patents Form 10/77)*	-
Any other documents *(please specify)*	-

11. I/We request the grant of a patent on the basis of this application.

Signature [signature] Date 24/4/03

MATHYS & SQUIRE

12. Name and daytime telephone number of person to contact in the United Kingdom: Michael C Moir - 020 7830 0000

Warning

After an application for a patent has been filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission from the Patent Office unless an application has been filed at least 6 weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) *If you need help to fill in this form or you have any questions, please contact the Patent Office on 08459 500505.*

b) *Write your answers in capital letters using black ink or you may type them.*

c) *If there is not enough space for all the relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.*

d) *If you have answered 'Yes' Patents Form 7/77 will need to be filed.*

e) *Once you have filled in the form you must remember to sign and date it.*

f) *For details of the fee and ways to pay please contact the Patent Office.*

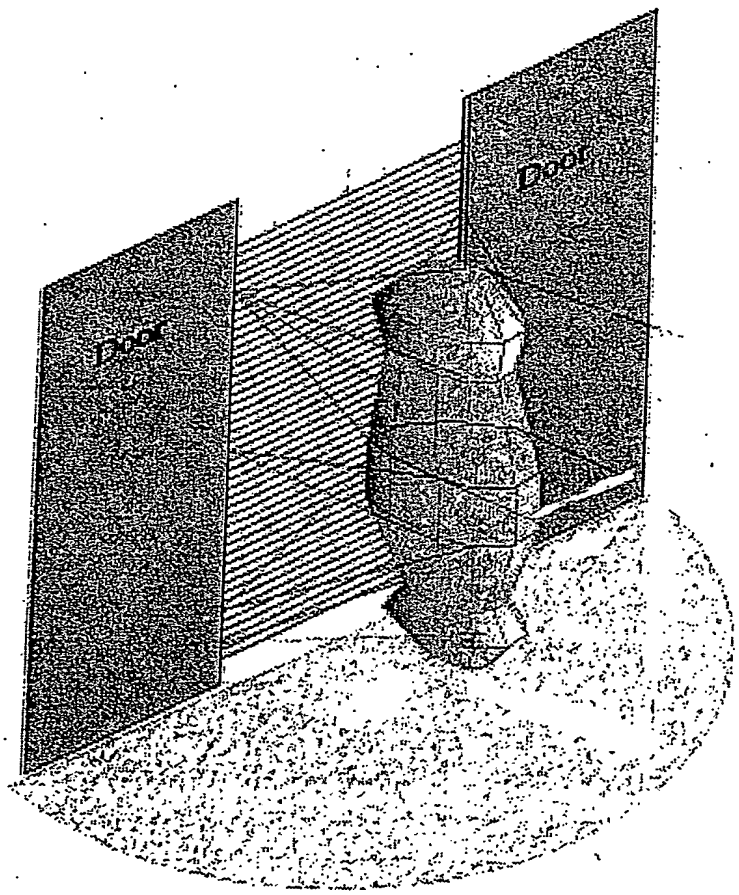


FIGURE 1

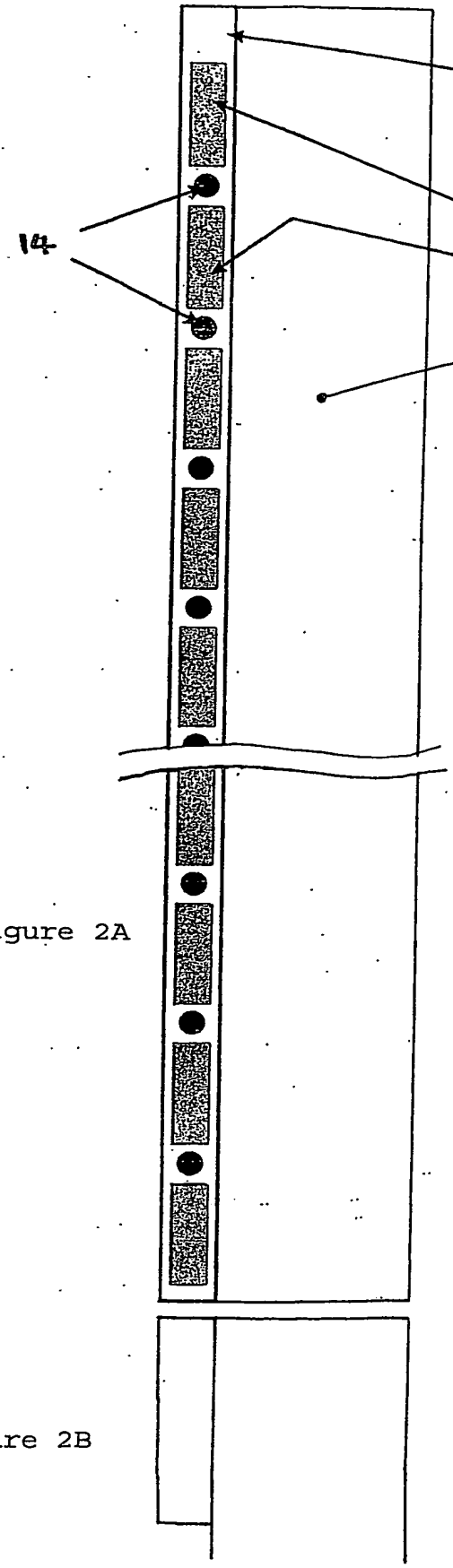


Figure 2A

Figure 2B

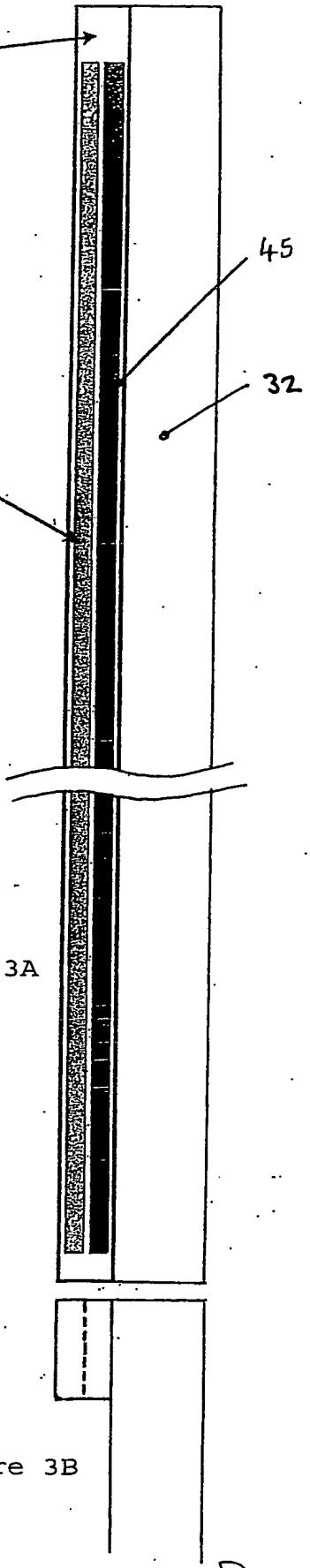


Figure 3A

Figure 3B

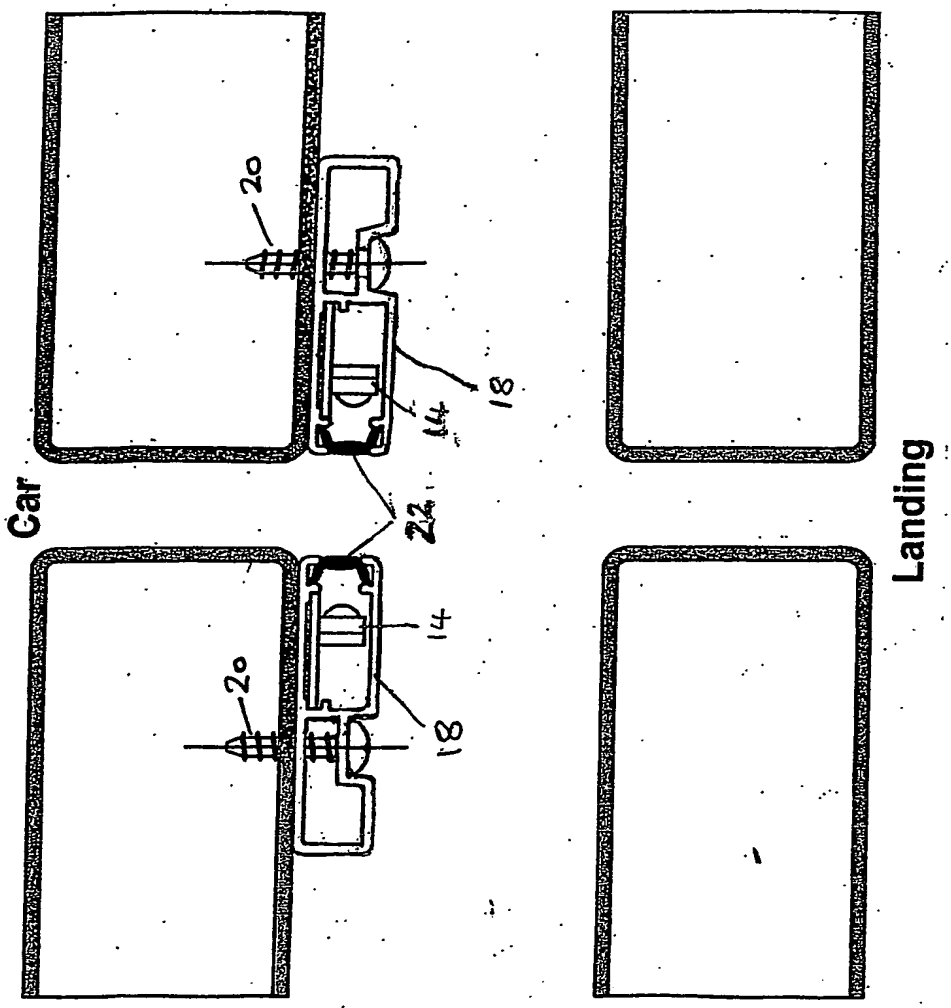


FIGURE 4

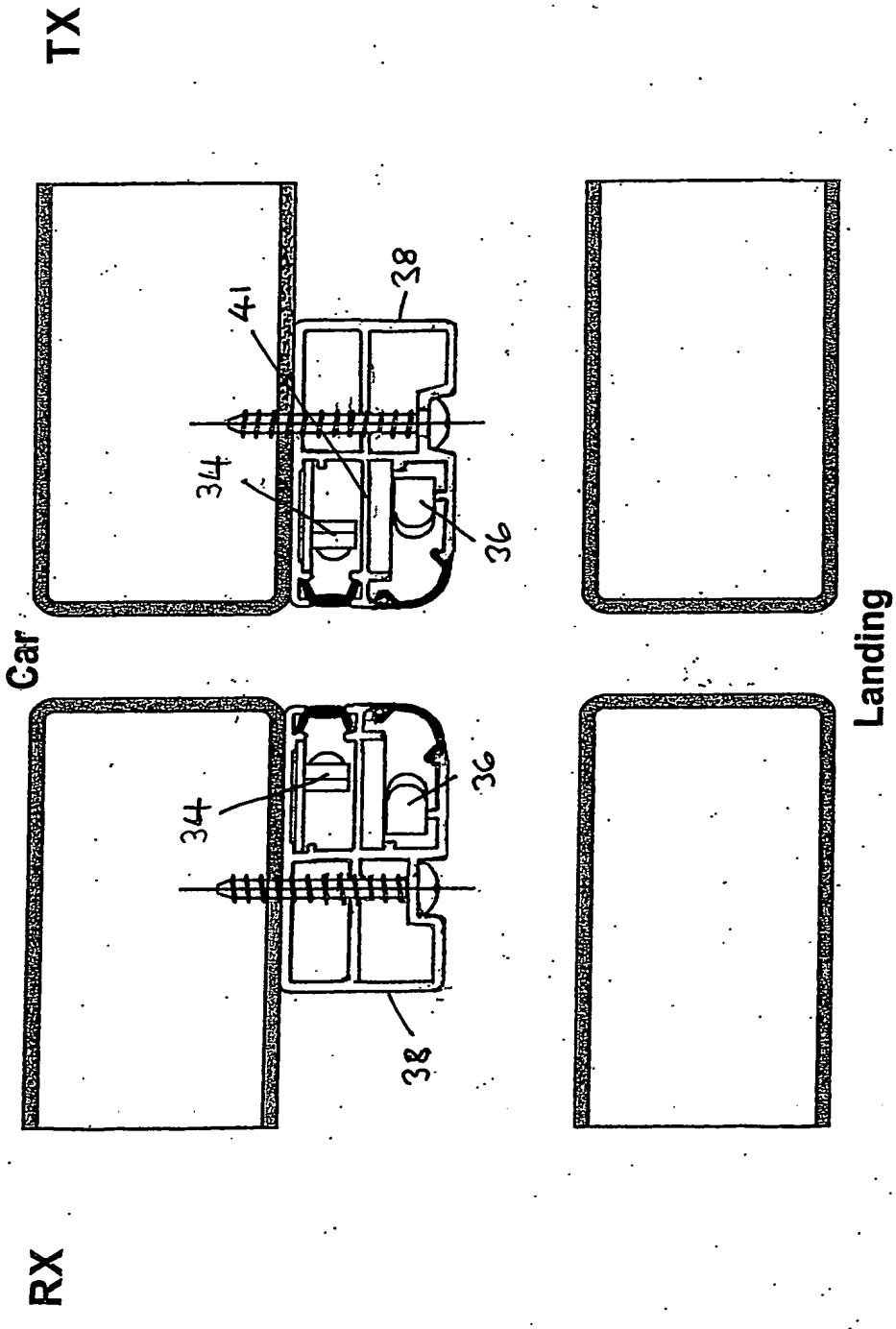


FIGURE 5

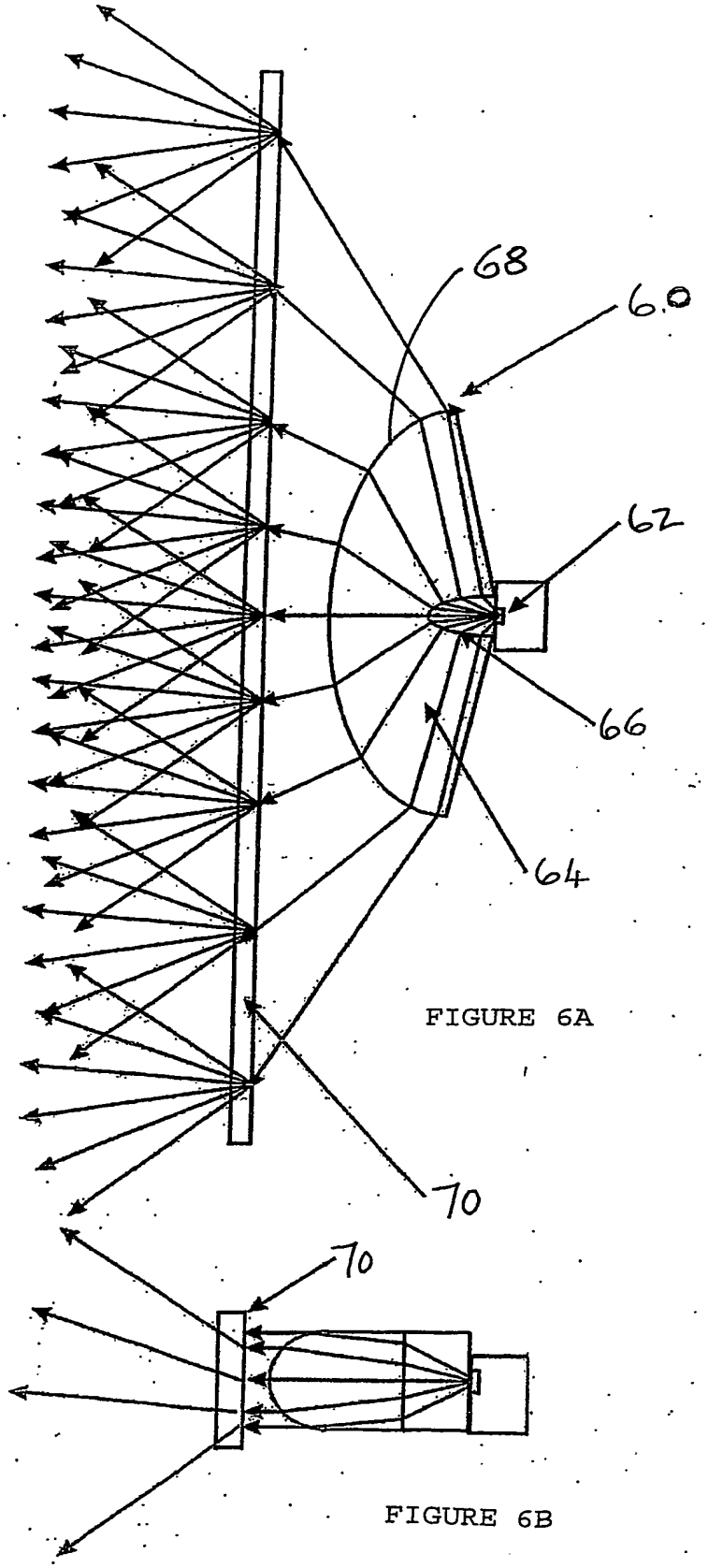


FIGURE 6A

FIGURE 6B

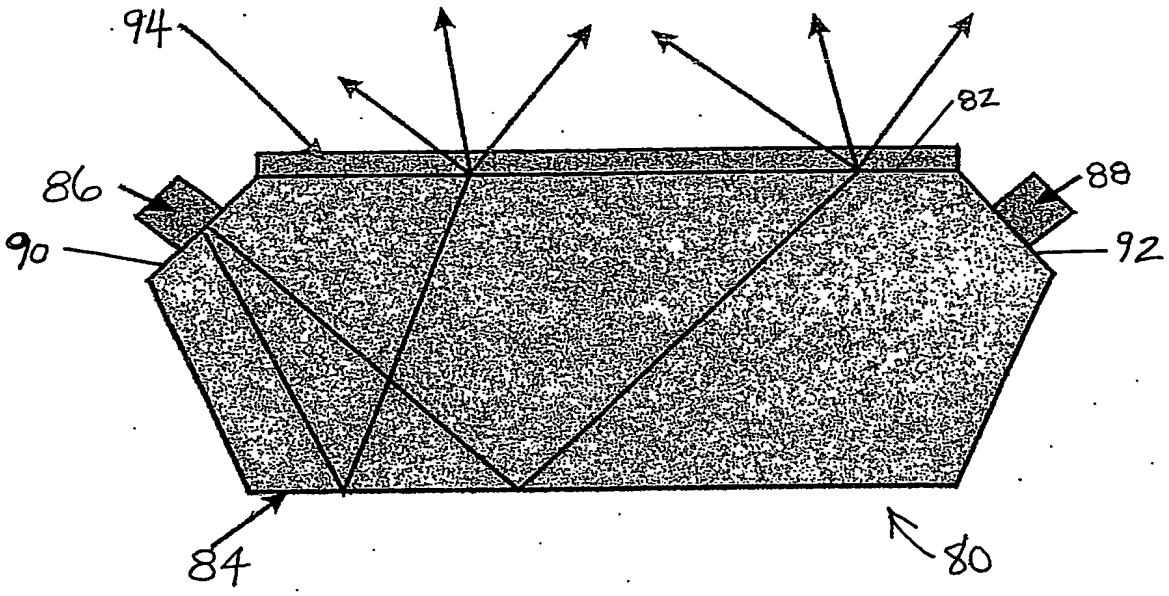


FIGURE 7

MULTIFUNCTION EDGE DEVICE FOR POWERED DOORS

The invention relates to an edge device for powered doors, such as elevator doors, and more particularly to an edge device that functions both as a safety sensor and as indicator lighting.

It is known to position infrared light detectors on the facing edges of elevator doors to allow beams to pass between those edges for preventing closure when persons are between the doors. One known system has a series of forty infrared transmitter diodes spaced in an array along substantially the whole length of one of the elevator doors, each diode transmitting a beam of infrared light, and a corresponding array of receiver diodes at respective facing positions on the other door for receiving the beams. An object passing between the doors breaks some of the beams, and the doors only close when all of the beams have been sensed by the corresponding receiver diodes. An improved version of such system, with a three-dimensional `detection zone' is also known. The improved version has the pairs of diodes extending in a plane as described above, but has additional transmitter diodes that transmit infrared beams at an angle outwardly of that plane, and additional receiver diodes for receiving light reflected from the beams by an object which, although not yet in the plane, is close to entering the plane; for instance, a person approaching or standing in front of the doors. This is illustrated in Figure 1.

Recently, for both practical and aesthetic reasons, visible lighting has been introduced along the facing edges of elevator doors. Diffusers have been used on the door edges to give the appearance of a single channel of light extending substantially along the whole length of each elevator door. Different light colours have been used to differentiate opening and closing of the doors.

Although it would be advantageous to accommodate both the infrared detectors and the light diffusers on the facing edges of elevator doors, difficulties have arisen because of the limited space available and because of interference effects between the infrared and visible light. The subject invention is directed to an effective way of allowing both infrared detectors and lighting to co-exist on the edges of powered doors.

In one aspect, the subject invention is an edge device for a powered door, including an elongate array of infrared transmitters and/or receivers and at least one illuminable element which extends with the array for a substantial part of the length thereof and which is adapted to be illuminated when the door is open (ie. fully open or moving between open and closed positions), the transmitter and/or receiver and the at least one illuminable element being disposed in a common carrier structure.

Preferably, in a first form of the edge device, the common carrier structure is a channel member; the at least one illuminable element is a series of illuminable elements; and, the infrared transmitters and/or receivers are

vertically interleaved in the common carrier structure with the series of illuminable elements along the length of the array, each adjacent pair of the illuminable elements being separated by a respective infrared transmitter or receiver.

Preferably, in a second form of the edge device: the common carrier structure is a channel member; the at least one illuminable element is a series of illuminable elements; and, the infrared transmitters and/or receivers extend vertically on a first side of the common carrier structure along the length of the array, and the series of illuminable elements extend vertically on a second side of the common carrier structure. More preferably, the edge device also includes a barrier member extending longitudinally in the channel to separate the first and second sides of the common carrier structure.

Each illuminable element may be a light source with a light-spreading cover lens. The cover lens may be cylindrical in one axis, with an elliptical outer curvature and an inner curvature such that light is constrained to leave the lens as a stripe with a generally equal light intensity at all points on the outer curvature. Preferably, the inner curvature has an eccentricity of unity or greater. More preferably, the inner curvature has a parabolic shape. Preferably, the cover lens is made of clear plastic. The light source may be a bicolour or tricolour diode.

Alternatively, each illuminable element may be a transparent block having a light diffuser on a front face, a reflective back face, and a side having a light source

angled to direct light toward the back face, the light reflecting off the back face and being diffused by the diffuser on the front face. Each illuminable element may also have a second side having a second light source angled to direct light toward the back face, the light reflecting off the back face and being diffused by the diffuser on the front face. More preferably, the two sides are opposite sides of the transparent block. Each light source may emit light of a respective different colour. Each light source is preferably a diode, and even more preferably a bicolour or tricolour diode. Alternatively, each light source may be a length of electroluminescent plastic wire.

The at least one illuminable element may include circuitry that is positioned so as to be isolated against interference from circuitry utilized by the elongate array of infrared transmitters.

The powered door may be an elevator door.

In another aspect, the invention is an illuminable element for an edge device, the illuminable element including a transparent body having a reflective rear face and a light diffuser on a front face. At least one light source is disposed at an angle to the rear face to direct light towards the rear face. The rear face reflects light from the light source toward the light diffuser, and the diffuser diffuses the light as it leaves the illuminable element.

Preferably, the at least one light source is a pair of light sources each positioned on a respective opposite side of the transparent body.

Preferably, each light source emits light of a respective different colour.

In a third aspect, the invention is an illuminable element that includes a light source, a light-spreading cover lens for redirecting light from the light source, and a light diffuser for diffusing the redirected light. The cover lens may be cylindrical in one axis with an elliptical outer curvature and an inner curvature such that light is constrained to leave the lens as a stripe with a generally equal light intensity at all points on the outer curvature.

Preferably, the inner curvature has an eccentricity of unity or greater, and more preferably, the inner curvature has a parabolic shape. Preferably the cover lens is made of clear plastic.

In the second and third aspects, each light source may be a diode. The diode may be a bicolour or tricolour diode.

Alternatively, each light source may be a length of electroluminescent plastic wire.

Preferred features of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Figure 1 is a prior-art perspective view of a pair of elevator doors with a three-dimensional detection zone created by a plurality of infrared transmitters and receivers on the door edges;

Figure 2A is a front view of a first embodiment of the multifunction edge device of the subject invention secured to an elevator door, a series of infrared transmitters and/or

receivers on the edge device being vertically interleaved with a series of illuminable elements;

Figure 2B is a bottom view of the multifunction edge device and elevator door of Figure 2A;

Figure 3A is a front view of a second embodiment of the multifunction edge device of the subject invention secured to an elevator door, a series of infrared transmitters and/or receivers extending vertically in parallel with a series of illuminable elements on the edge device;

Figure 3B is a bottom view of the multifunction edge device and elevator door of Figure 3A;

Figure 4 is a plan view showing a pair of landing doors and also showing a pair of the multifunction edge devices of the first embodiment each secured to a front edge of a respective elevator door, the edge devices extending in the space existing between the elevator doors and landing doors;

Figure 5 is a plan view showing a pair of landing doors and also showing a pair of the multifunction edge devices of the second embodiment each secured to a front edge of a respective elevator door, the edge devices extending in the space existing between the elevator doors and landing doors;

Figure 6A is a side view of a beam-spreading lens assembly that may be used as the illuminable element;

Figure 6B is an end view of the beam-spreading lens assembly of Figure 6A; and,

Figure 7 is a side view of a transparent block that may be used as the illuminable element;

The first embodiment of the invention is illustrated in

Figures 2A, 2B and 4. In Figure 2A, the edge device 10 is connected to a front edge of elevator door 12 and has a series of infrared transmitting and/or receiving devices 14 interleaved with a series of illuminable elements generally designated 16. The transmitting and/or receiving devices 14 are of the same type as those shown in prior-art Figure 1. The illuminable elements 16 are of two types, as will be subsequently more fully described. The devices 14 and illuminable elements 16 share a common housing 18 (which can be metal or plastic). As shown in Figure 4, the housing 18 is secured to the elevator door 12 by a series of screws 20. The front of housing 18 is covered by a cover 22 which is transparent except for a series of rectangular windows 24, textured for diffusing visible light, as shown in Figures 2A; as also shown in that figure, the infrared devices 14 show through at respective transparent portions of the cover 22.

The infrared receivers are `blind' to the light of the coloured diodes because of inbuilt infrared filters, so there is no need to provide a cover screen. However, it may be necessary to separate and shield the illuminable-element circuitry from the infrared device circuitry because of possible interference.

The second embodiment of the invention is illustrated in Figures 3A, 3B and 5. In Figure 3A, the edge device 30 is connected to a front edge of elevator door 32 and has a series of the infrared transmitting and/or receiving devices 34 extending in parallel with a series of the illuminable elements 36. The transmitting and/or receiving devices 34

are of the same type as those shown in prior-art Figure 1. As with the first embodiment, the illuminable elements 36 may be of two types that are subsequently more fully described. The infrared devices 34 and illuminable elements 36 share a common housing 38 which is approximately twice as wide as the housing 18 of the first embodiment. As shown in Figure 5, the housing 38 is secured to the elevator door 32 by a series of screws 40.

In Figure 5, the infrared devices 34 and illuminable elements 36 are separated in the housing 38 by a central web 41. The front of housing 38 is covered by a cover 42 which is transparent except for a long narrow window 44, textured for diffusing visible light, as shown in Figures 3A. A parallel second long narrow window is formed by a continuous infrared device cover 45 (shown in Figure 5) that sits behind the transparent cover 42 and forward of a series of the infrared devices 14; the device cover 45 could be formed integral with the series of infrared devices 14 in the housing 38.

Figures 4 and 5 illustrate the relative position between pairs of elevator doors 12, 32, each carrying an edge device of the invention, and a respective pair of landing doors 26, 46, found on each floor of the building housing the elevator. The thickness of the edge devices is such that there is sufficient clearance between the outside of the devices and the surrounding stationary structure of the elevator well that vertical movement of the elevator car is not impeded. In the first and second embodiments, the RX and TX

designations in Figures 4 and 5 are to indicate that all of the infrared receiver devices 14, 34, are on the respective left elevator door while all of the infrared transmitter devices 14, 34, are at respective opposite positions on the respective right elevator door. Each elevator door could, however, have both a series of transmitter devices and a series of receiver devices, with the complementary series of receiver devices and transmitter devices being on the other elevator door.

The two types of illuminable elements 36 are shown in Figures 6 and 7. The first type 36A, shown in Figures 5, 6A and 6B, consists of a lens assembly generally designated 60 that comprises a coloured light-emitting diode (LED) 62 that sits within a cylindrical plastic lens 64 having a parabolic inner section 66 and an elliptical outer section 68. Although a parabolic inner section is used, the inner section could be any conic section that has an eccentricity of unity or greater. Combining a parabolic inner section with an elliptical outer section has been found to be very effective at producing even spreading of the light that passes through the plastic lens 64, and avoids a pattern of light emerging from the lens with a dim centre area and bright exterior areas or vice versa. The plastic lens 64 redirects light from the LED 62 so as to spread the light as it passes to the inside surface of the plastic diffuser 70. In the first and second embodiments, the plastic diffuser 70 is formed by the respective diffusing windows 24 and 44 described above.

The second type 36B of illuminable element 36, shown in

Figure 7, consists of a transparent plastic block 80 having a front face 82 and a reflective back face 84. At least one of the sides of block 80 has a bicolour or tricolour LED mounted thereon for transmitting light such that the light reflects off the back face 84 toward the front face 82. The embodiment of Figure 7 has two LEDs 86, 88 mounted on respective sides 90, 92 of block 80. A plastic diffuser 94 sits on the front face 82 of block 80. The plastic diffuser 94 may be formed by the diffusing window 24 or 44 of the respective first and second embodiments.

The LED(s) of each illuminable element are at least able to indicate the colours green and red. The following chart indicates the colours displayed with corresponding actions:

Colour	Corresponding Action
1. Green glow immediately:	Doors start to open;
2. Red glow, after delay:	Doors are fully opened;
3. Red glow, after delay:	Lift called to another floor;
4. No glow:	Doors are fully closed;
5. Flashing, then solid red	`Close Doors' button pushed;
6. Flashes red	Door nudging activated.

Besides the LEDs, an alternative light source in the form of newly-developed electroluminescent plastic wires, may be used. Such materials give out a rather dim light at present, but their light output is improving steadily. A binary or multi-element strip or wire of such plastic could be run alongside the infrared detector assembly and would not require the use of the diffuser previously mentioned. Various colours would be providing by activating one, or

several, strips as necessary. Electroluminescent plastic wires would also allow complex shapes and multicolour patterns of light emission to be created. The wires are formed as coaxial cable, with phosphor (for example, ZnS) in the cylindrical region separating the two conductors of the cable.

While the present invention has been described in its preferred embodiments, it is to be understood that the words which have been used are words of description rather than limitation, and that changes may be made to the invention without departing from its scope as defined by the appended claims.

Each feature disclosed in this specification (which term includes the claims) and/or shown in the drawings may be incorporated in the invention independently of other disclosed and/or illustrated features.

The text of the abstract filed herewith is repeated here as part of the specification.

An edge device for an elevator door includes an elongate array of infrared transmitters and/or receivers and a proximate elongate array of illuminable elements, both arrays extending for a substantial part of the length of the door. The illuminable elements are adapted to be illuminated when the door is in motion. The two arrays are disposed in a common carrier structure, being either vertically interleaved or extending vertically in parallel with each other.

CLAIMS:

1. An edge device for a powered door, comprising an elongate array of infrared transmitters and/or receivers and at least one illuminable element which extends with the array for a substantial part of the length thereof and which is adapted to be illuminated when the door is open, the transmitter and/or receiver and the at least one illuminable element being disposed in a common carrier structure.

2. The edge device of claim 1, wherein:

the common carrier structure is a channel member;

the at least one illuminable element is a series of illuminable elements; and,

the infrared transmitters and/or receivers are vertically interleaved in the common carrier structure with the series of illuminable elements along the length of the array, each adjacent pair of the illuminable elements being separated by a respective infrared transmitter or receiver.

3. The edge device of claim 1, wherein:

the common carrier structure is a channel member;

the at least one illuminable element is a series of illuminable elements; and,

the infrared transmitters and/or receivers extend vertically on a first side of the common carrier structure along the length of the array, and the series of illuminable

elements extend vertically on a second side of the common carrier structure.

4. The edge device of claim 3, also comprising a barrier member extending longitudinally in the channel to separate the first and second sides of the common carrier structure.

5. The edge device of any one of claims 1 to 4, wherein each illuminable element is a light source, a light-spreading cover lens for redirecting light from the light source, and a light diffuser for diffusing the redirected light.

6. The edge device of claim 5, wherein the cover lens in one axis is cylindrical with an elliptical outer curvature and an inner curvature such that light is constrained to leave the lens with a generally equal light intensity at all points on the outer curvature.

7. The edge device of claim 6, wherein the inner curvature has an eccentricity of unity or greater.

8. The edge device of claim 7, wherein the inner curvature has a parabolic shape.

9. The edge device of any one of claims 5 to 8, wherein the cover lens is made of clear plastic.

10. The edge device of any one of claims 5 to 9, wherein the light source is a bicolour or tricolour diode.

11. The edge device of any one of claims 5 to 9, wherein the light source is a length of electroluminescent plastic wire.

12. The edge device of any one of claims 1 to 4, wherein each illuminable element is a transparent block having a light diffuser on a front face, a reflective back face, and a side having a light source angled to direct light toward the back face, the light reflecting off the back face and being diffused by the diffuser on the front face.

13. The edge device of claim 12, wherein each illuminable element also has a second side having a second light source angled to direct light toward the back face, the light reflecting off the back face and being diffused by the diffuser on the front face.

14. The edge device of claim 13, wherein the two sides are opposite sides of the transparent block.

15. The edge device of claim 13 or 14, wherein each light source emits light of a respective different colour.

16. The edge device of any one of claims 12 to 15, wherein each light source is a diode.

17. The edge device of any one of claims 12 to 15, wherein each light source is a bicolour or tricolour diode.

18. The edge device of any preceding claim, wherein the at least one illuminable element includes circuitry that is positioned so as to be isolated against interference from circuitry utilized by infrared transmitters.

19. The edge device of any preceding claim, wherein the edge device is adapted to be used on an elevator door.

20. An illuminable element for an edge device, the illuminable element comprising a transparent body having a reflective rear face and a light diffuser on a front face, at least one light source being disposed at an angle to the rear face to direct light towards the rear face, the rear face reflecting light from the light source toward the light diffuser, the diffuser diffusing the light as it leaves the illuminable element.

21. The illuminable element of claim 20, wherein the at least one light source is a pair of light sources each positioned on a respective opposite side of the transparent body.

22. The illuminable element of claim 20 or 21, wherein each light source emits light of a respective different colour.

23. An illuminable element, comprising a light source, a light-spreading cover lens for redirecting light from the light source, and a light diffuser for diffusing the redirected light, wherein the cover lens in one axis is cylindrical with an elliptical outer curvature and an inner curvature such that light is constrained to leave the lens with a generally equal light intensity at all points on the outer curvature.

24. The illuminable element of claim 23, wherein the cover lens has an inner curvature with an eccentricity of unity or greater.

25. The illuminable element of claim 24, wherein the inner curvature has a parabolic shape.

26. The illuminable element of any one of claims 23 to 25, wherein the cover lens is made of clear plastic.

27. The illuminable element of any one of claims 20 to 26, wherein each light source is a diode.

28. The illuminable element of any one of claims 20 to 26, wherein each light source is a bicolour or tricolour diode.

29. The illuminable element of any one of claims 20 to 26, wherein each light source is a length of electroluminescent plastic wire.

30. An edge device substantially as herein described with reference to and as shown in the accompanying drawings.

31. An illuminable element substantially as herein described with reference to and as shown in the accompanying drawings.

ABSTRACT

MULTIFUNCTION EDGE DEVICE FOR POWERED DOORS

An edge device for an elevator door includes an elongate array of infrared transmitters and/or receivers and a proximate elongate array of illuminable elements, both arrays extending for a substantial part of the length of the door. The illuminable elements are adapted to be illuminated when the door is in motion. The two arrays are disposed in a common carrier structure, being either vertically interleaved or extending vertically in parallel with each other.

(Figures 2A, 2B, 3A and 3B for publication)